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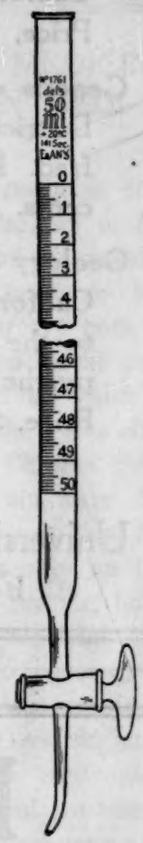

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THE DEPARTMENT OF MEDICINE AT THE PEKING UNION MEDICAL COLLEGE

THE introduction of western medicine into China has been due, thus far, largely to the therapeutic success of surgery and the various surgical specialties. Internal medicine has lagged a long distance behind surgery both in the attention which it has received in the mission hospitals and in the extent to which it has influenced the Chinese people. One frequently hears it said that the Chinese "like western surgery, but they do not care for western medicine," and a corollary is that for "internal disease" they prefer to rely on the native system of practice. The fact is, however, that our western internal medicine has not yet been given a fair chance to demonstrate its worth. Practitioners of western medicine in China—for the most part, of course, missionaries—have found themselves confronted by an enormous number of surgical problems, many of them presenting direct emergencies, and it is natural that these cases should have received the first attention. Traumatic injuries, infections and large superficial tumors can often be easily and quickly alleviated, and their cure produces a profound impression on the patient and on his friends, but the diagnosis and treatment of strictly medical diseases is much more time consuming and the results are usually far less obvious and striking. With the days so full of pressing surgical problems and with the frequent lack of the facilities for modern medical diagnosis, it is not surprising that, with few exceptions, the medical patients have received somewhat scant attention. Even among the lower classes the Chinese often manifest great power of discrimination and an appreciation of careful, thorough attention, and if western internal medicine is to make its way with them it must be presented in the best possible manner.

Under these circumstances, it is of interest to watch the development at the Peking Union Medical College of a medical clinic which in its personnel and equipment would take high rank on any continent.

The Peking Union Medical College moved into its new quarters in the summer of 1921, and the department of medicine, with its wards, laboratories, offices and out-patient department, is centralized in the hospital and directly connected with the buildings of the medical school proper. It thus has the great advantage of being organically connected with the laboratories of the preclinical sciences, so that close association between clinical and preclinical workers is facilitated. In addition, the department of medicine is only a few steps from the library, which contains a considerable and well selected assortment of books as well as files of all the more important scientific journals. The medical wards occupy three floors in a large pavilion and contain 75 beds, only about half of which are now in use, in large and small rooms. In addition, there is an emergency isolation ward of six beds, and there are also medical patients, both Chinese and foreign, in the private pavilion. The general arrangements of the wards are exactly similar to what one finds in the best modern hospitals in America.

The nursing is at present carried on by a staff of Chinese and foreign graduate nurses, with Chinese male nurses under a woman graduate in the male wards, but a nurses' training school, based on the highest American ideals and standards, has been established, which admits only women as pupils, and it is hoped that before long most of the ward work can be carried on by the pupil nurses. Connected with each medical ward is a laboratory for routine clinical examinations. Adjoining the medical wards, on the ground floor, is the medical out-patient department with its waiting room, laboratory, and about a dozen rooms for the examination and treatment of patients, while on the two floors above are the offices, laboratories and class rooms of the department of medicine. Ample quarters and complete equipment are here provided for special study and investigation by the members of the department. Adjoining the office of the professor of medicine, on the third floor, are laboratories devoted to chemistry; and next to the associate professor's office are the laboratories for bacteriology. Across the hall is the laboratory of neuropathology, and an ample suite of rooms for the electrocardiograph, which is, in addition, wired to all the wards in the hospital. On the second floor is the laboratory of clinical pathology, with a large room for class instruction and smaller rooms in which the bacteriology and serology for the hospital is carried out, other laboratories for special workers, and a spacious room for clinical demonstrations. All the members of the staff of the department of medicine devote their time exclusively to hospital work and teaching, and the staff is large enough to allow each one to have fairly adequate time for study and investigation. The professor of medicine and chief of the medical service of the hospital is Dr. F. C. McLean (M.D. Rush Medical School) and the associate professor is Dr. O. H. Robertson (M.D. Harvard Medical School), both of whom were formerly connected with the Rockefeller Institute. Dr. Andrew H. Woods (M.D. University of Pennsylvania), who was formerly on the staff of the Canton Christian College, is associate professor of neurology. The other members of the department are Dr. C. W. Young, Dr. J. H. Korns, Dr. H. J. Smyly and Dr. R. H. P. Sia. The house staff is organized with a resident physician, three assistant resident physicians (at present all Chinese graduates of American medical schools) and a group of interns who are for the most part graduates of medical schools in China. When the new Peking Union Medical College has been longer in existence the majority of the interns will be graduates of this school because a fifth, or intern year, is required for the degree. Since the standards of instruction of the school are analogous to those of the best institutions in America, the graduates will make highly satisfactory interns. In the year 1921-22 there were only three classes under instruction. Instruction of a fourth year class will begin this fall.

Peking has a temperate climate, hotter than New York in summer, considerably colder than

New York in winter, and usually very dry. One does not find here, therefore, the strictly tropical diseases, except as they may be imported from central and south China. In general, the diseases usually met with in the medical wards are less different than one might expect from what is seen in the United States. Tuberculosis, and especially pulmonary tuberculosis, is very common. There are many acute infections of the respiratory tract, but lobar pneumonia is probably somewhat less common than in northern United States. Typhoid fever, in spite of much that is said about the Chinese having an inherited or acquired immunity to it, is common and the mortality is about what we expect in America. Syphilis abounds in all its manifestations. It has been repeatedly stated that syphilis of the central nervous system is rare among the Chinese, but more careful studies have disproved this point, and the extraordinarily interesting neurological clinic in Peking contains its full quota of syphilitic cases. Dysentery, both bacillary and amœbic, occurs with great frequency in the summer and autumn, and malaria, usually the tertian form, is not uncommon. Scarlet fever and small pox are seen often; relapsing fever and typhus fever are not at all unusual; and leprosy is sometimes seen. The infection which appears most often, however, and which is at the same time new to those of us educated in America, is kala-azar. Every patient with a large spleen is suspected of having kala-azar, and four to six patients undergoing treatment in the wards is not unusual. There are many cases of acute and chronic nephritis, similar to what we seen in the west, but one gets the impression that instances of essential hypertension are far less common in China than in America. Simple goitre is endemic in parts of the country around Peking and one sees enormous tumors, but exophthalmic goitre, while it occurs, is rather strikingly unusual. Diabetes, which was also formerly held to be very rare in China, is found quite frequently if routine examinations for sugar are made, but it usually occurs in patients past middle age and runs typically a mild course, the glycosuria disappearing with only slight alteration of diet. Heart disease is common, and the types met with are usually the chronic myocardial cases in older people, or cases on a syphilitic basis with an aortitis and perhaps a lesion of the aortic valve. Acute rheumatic fever is distinctly uncommon in Peking and as a result rheumatic heart disease is comparatively rarely seen. Cases of beri-beri come to the clinic occasionally, but they almost always occur in patients who have come from the south, for the disease does not seem to be indigenous in North China. Neoplasms, benign and malignant, of all varieties are common and one sees many of them in stages that are more advanced than we are accustomed to nowadays in the west. A cirrhosis of the liver with ascites, said to occur characteristically in farmers, is another interesting and new type of disease entity. Finally, in addition to many cases of organic neurological disease, there are numerous patients with all sorts of neuroses and psychoses. In general, therefore, the medical clinic in Peking is marked particularly by the great variety of disease. One finds most of the diseases that we are accustomed to see in America, and in addition a good many new types.

What makes the clinic especially stimulating and interesting, however, is the possibility of studying the cases carefully. The number of hospital beds available for medical patients is not nearly sufficient to allow all those who apply to the out-patient department and who are in need of institutional care, to be admitted, and a careful selection has to be made. Those who are particularly in need of hospital treatment are, of course, immediately referred to the wards, no matter what they are suffering from, but under other circumstances the principle which determines whether or not a patient shall be admitted depends on the fact that the hospital is essentially a teaching institution. The cases taken into the wards are, therefore, chosen in large part because they are particularly suitable for teaching purposes or because they offer problems for special investigation. The result of this method of selection, which is determined by the size and character of the hospital, is a medical clinic of unusually interesting cases. All of the patients are studied in great detail by the house staff and in many instances special observations are made by

members of the senior staff who may be concerned with the problems presented by individual patients. The various aspects of the cases are then discussed at the daily visits when all the members of the medical department join the house staff in the wards. In addition to these exercises, of a strictly clinical nature, other opportunities are provided to enable the men to keep in touch with the work which is being done by their colleagues in Peking and elsewhere in the medical world. On Saturday mornings the whole staff meets for an hour in the laboratories while one of the members talks to them about his researches, or about some of the broader fields with which he is in close touch; once a fortnight the Medical Society meets for the more formal presentation of papers; and at a similar interval the "Review Club" discusses special topics from the medical literature. The fact that the faculty of the medical school is so large (about forty members, besides assistants in clinics and laboratories), that so much progressive scientific work is being carried on in all departments, and the relations between the departments are so intimate and harmonious, makes it almost impossible for one to be a member of the staff and fall by the professional wayside. To many people in America, China may seem to be remote and Peking an outpost of western civilization, but to those who know the situation the Peking Union Medical College is progressing hand in hand with the foremost medical schools of the world on the frontier of scientific medicine.

FRANCIS W. PEABODY
BOSTON CITY HOSPITAL

A FIRST COURSE IN GENERAL CHEMISTRY[1]

THE opportunity to take part in a discussion on the above topic is highly appreciated, particularly because during the past twenty years I have had an exceptional opportunity to try out certain ideas relating to the teaching of general chemistry to first year students at the Phillips Exeter Academy. Since Dr. Gordon stated that I could confine the discussion either to content or method or both I shall probably avail myself to the limit of this proviso.

Since my main criticism of the majority of papers thus presented has been that the statements have been too general, and that there has been too little of what was definite and capable of being carried away by the listener and put into immediate practice, perhaps I may be allowed to speak rather personally in parts, and to mention existing texts by name.

There stand before me on the desk fourteen of the more modern texts from which the secondary school teacher must usually choose the one to use with his classes. From these, three must reluctantly be dropped out of our consideration. The excellent "Text-book of Chemistry," by W. A. Noyes, is designed for use with college students, although it is so written as to be suitable for college students who have had no chemistry. As I interpret the subject before us to refer to the first year student in chemistry during his period of *preparation for* college, we must consider the large difference in the mental attitude of the student towards his subject manifested in the last years of secondary school and in the early years of college. Vivian's "Every-day Chemistry" and "Chemistry and Its Relation to Daily Life," by Kahlenberg and Hart, must be laid aside because, although they are designed for use in secondary schools, they are adapted particularly to students of agriculture and home economics. Students, should, however, have access to these two texts which show successfully how live and every-day a subject chemistry is.

In this connection it may be interesting to note that at a recent meeting of the New England Association of Chemistry Teachers a text-book survey was made. Of those present about one third used McPherson and Henderson's "Elementary Study of Chemistry," about one third used "Elementary Principles of Chemistry," by Brownlee and Others, while the remaining one third were divided among McFarland's "Practical Elementary Chemistry," Black and Conant's "Practical Chemistry" and Newell's "Chemistry" in about the ratio of 2 : 2 : 1, respectively. I shall have occasion to refer again to these five books, as well as incidentally to the other six before me.

I have never been able to understand why

[1] Paper read before the American Chemical Society at its meeting in April.

practically all texts written for the beginner in chemistry start in with oxygen, hydrogen, the gas laws, and water, to be followed soon with atoms, molecules, symbols, formulas and equation writing. It has always seemed to me more logical to start, not with gases, but with some solids, such as metals, with which the student may have had some slight acquaintance before entering the class. It is my belief that the ordinary student can at first get more tangible results from the more tangible substances, and that introducing him from the start to gases which he can hardly see, smell, taste, or handle is likely to discourage him from the start, particularly if these introductory substances are tangled up with that bugbear to so many students—the gas laws. A splendid opportunity is lost to tie the subject from the beginning in the student's mind to things that he has handled, or can handle, easily in every-day life.

My convictions were so strong that some years ago I worked out a scheme of experimentation in which the student started with such common metals as copper, zinc and iron, and followed these with magnesium, phosphorus and mercury. After a rather full study of the properties of the elements themselves, heating them in air introduced him to the subjects of oxidation and combustion. Without going into details, I might say that the first ninety experiments led him through sulfur, carbon and chlorine and the acids formed from these, the analysis and synthesis of water, and then sodium, potassium and calcium and their common compounds in such a way that each experiment grew naturally out of those preceding it and led up to an investigation of a (to him) unknown substance, namely, saltpeter, which he investigated by means of sulfuric acid and by appropriate experiments on the distillate, with the result that by this procedure he determined for himself the composition of both saltpeter and nitric acid. All of this work was completed without the mention of atom or molecule and without a symbol or a formula. It is my belief that the performing of these ninety experiments revealed to the student the methods of thought used by the chemical investigator in attacking his problem—the same method that he (the student) should use on a small scale in solving his own difficulties. I tried in this way to teach the student how to *think* his own way out of his difficulties.

You will probably be asking if no equations were used in these experiments. Yes, there were—the kind of equation that McPherson and Henderson hint at in their chapters on oxygen and hydrogen in both of their texts. Newell, Brownlee, Black and Conant and some others use the same device to a limited extent, but I developed that form of equation writing so that instead of using the names of the compounds with pluses and arrows, the student early got into the habit of representing each chemical reaction by an equation in which each compound was represented by the names of the elements which they had discovered that compound to contain, each compound being enclosed in a set of brackets. By this method the students acquired a very personal and first-hand acquaintance with the behavior of many chemicals with each other, and they got a very good conception, based upon actual laboratory work, that certain compounds contained such and such things, not because the formula was, for instance, Na_2SO_4, not because the book said so, but because they had proved it themselves. It must be admitted that such an attitude in the student's mind is not to be scoffed at. The main question that arises is: "Have we time nowadays for such a method, or is the subject so big that we must present the material in a pretabulated and almost in a predigested form?"

Of course this set of ninety experiments was simply introductory to text matter on the theory in chemistry with experiments to illustrate the laws and principles. Then came symbols and formulas and their use in equation writing, and finally considerable descriptive chemistry studied in the light of present theoretical conceptions, but with the spirit of the inductive method still an unconscious guide.

It is only fair to say that in those years each student performed probably 150 or more experiments, and that although it was my opinion that he was being taught *chemistry* rather than a *text-book,* the school year was not long

practically all texts written for the beginner in chemistry start in with oxygen, hydrogen, the gas laws, and water, to be followed soon with atoms, molecules, symbols, formulas and equation writing. It has always seemed to me more logical to start, not with gases, but with some solids, such as metals, with which the student may have had some slight acquaintance before entering the class. It is my belief that the ordinary student can at first get more tangible results from the more tangible substances, and that introducing him from the start to gases which he can hardly see, smell, taste, or handle is likely to discourage him from the start, particularly if these introductory substances are tangled up with that bugbear to so many students—the gas laws. A splendid opportunity is lost to tie the subject from the beginning in the student's mind to things that he has handled, or can handle, easily in every-day life.

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enough in which to prepare him by this method for the examination set by the college entrance examination board, although these same students had little or no trouble in passing the Harvard chemistry paper as set at that time. As the business of our school is to fit students for the college examinations it will be evident that by working out this little piece of educational research I was sacrificing much and I reluctantly had to decide to replace my own text with one of the other texts already mentioned. But I satisfied myself that the chemical instruction as ordinarily practiced was susceptible of considerable improvement and that in my own mind I was on the right track.

As I look back at the experience now I suspect I overdid the laboratory side of the scheme, and it seems plausible that an abbreviated and modified presentation following my general outline might perhaps lead to a more generally accepted method of presenting our subject. I have gone into some detail on this method, not because I think it might offer the eventual solution, but incidentally to show what has been done and primarily as a protest against the stereotyped method of plunging the beginner into the intangibility of gases.

Bradbury's "Inductive Chemistry" is the only text I have seen that approximates the method I have outlined. This book starts the student on sulfur, leads on through compounds of sulfur with some familiar metals to some metals themselves, and then takes up carbon as an example of a non-metallic solid; he loses out, however, by making all this textual instead of the basis for laboratory work. Lest I give a wrong impression of this book let me add that succeeding pages deal with oxides, atomic theory, hydrogen compounds, the sodium group, the chlorine group, and oxy-acids and their salts.

The student should certainly have a clear conception of the terms and phrases he uses in talking about chemistry, but I doubt very much if the extreme niceties of definition and fine drawings of line that characterize Alexander Smith's books are likely to appeal to the beginner, however much the teacher may admire these qualities.

Blanchard and Wade's "Foundations of Chemistry" is a valuable addition to elementary chemistry literature, and agreeably attractive, too, but I always lay it down feeling sorry that so many things are not there. I have never been able to get really enthusiastic over Hessler and Smith's "Essentials of Chemistry"; the directions for the laboratory work look more satisfactory than the text itself. Perhaps the too frequent use of fine print leaves the impression that much of the material presented is not of prime importance. Dull's "Essentials of Modern Chemistry" strikes closer home. It makes me wish I were a student again and just beginning chemistry, although he too starts in with oxygen, hydrogen and water, and that conflicts with my pedagogical ideas.

For several years now we have been using at Exeter Brownlee's text, but we tie up with it McPherson and Henderson's "Laboratory Manual," as we consider this manual better worded for and better suited to the elementary student.

The chemistry syllabus of the college entrance examination board has been a valuable aid in indicating to secondary school teachers what topics should be covered in the first year's course. It has been noted by some teachers, however, that those who set the paper sometimes seem to feel that the paper they set should touch in some way on almost every topic in the syllabus. This fact, together with the large number of topics in the syllabus, make it necessary for the teachers to spend the whole year covering the topics in the syllabus. If a majority of the colleges could agree to be satisfied with a smaller number of topics but have these covered more thoroughly, perhaps the board would revise the chemistry syllabus accordingly. This would be a boon to many teachers in that they would have time to cover the essential parts more thoroughly and would have a little time left to dwell upon such special topics as they find appealing to their classes or appropriate to the localities where they teach. I feel sure that secondary teachers may be depended upon not to take advantage of such diminution in requirements. Those who might be thus guilty could with advantage to the profession be eliminated.

Elementary chemistry teachers are much indebted to the college men who have written

chemistry texts for them and for the vast amount of time and thought they have spent in the preparation thereof. I often wonder, however, if the college teacher who lives and works among college students and does some research on the side can be expected to guage the needs of the secondary student and to put himself in the place of the secondary school teacher. If such a college man could have an opportunity to fill the position of a secondary school teacher of chemistry for a period of say five years, and have to make his living thereby, I'd welcome a text he might produce. Or must we wait till the profession of chemistry teaching in secondary schools has become sufficiently established to attract men of the requisite scholarship, knowledge of chemistry, acquaintance with what the colleges should require for entrance, and above all a close knowledge of the mental equipment of students of secondary school age before we can expect a solution of the problem: "What should be taught in first year chemistry and how should it be presented?"

WILHELM SEGERBLOM
PHILLIPS EXETER ACADEMY

THE PHYSICO-CHEMICAL MECHANISM OF MUTATION AND EVOLUTION

IT is the general rule in biology that descendants resemble parents, and that a parent organism can not pass on to offspring a factor which the parent did not receive from the germ-plasm of its immediate progenitors. Many apparent exceptions to this general rule have been traced to the existence in the parent gametes of recessive factors, which, while suppressed in the parent, may be liberated again in the offspring. Whether we accept the view of Darwin that large differences can represent the summation of small differences, or the more probable view of Bateson and others, that mutation or variation is a definite physiological event, no satisfactory explanation has been given as to the origin or source of these exceptions to the general rule of resemblance, although they constitute the steps by which evolution haltingly proceeds.

The crying need that we must find a chemical, physical or physico-chemical basis for mutation or variation has been voiced by many. Thus in his address before the British Association for the Advancement of Science (Australia, 1914, reprinted in *Smithsonian Report*, 1915, pp. 359-394), Sir William Bateson says: "Every theory of evolution must be such as to accord with the facts of physics and chemistry, a primary necessity to which our predecessors paid small heed. . . . Of the physics and chemistry of life we know next to nothing. Somehow the characters of living things are bound up in properties of colloids, and are largely determined by the chemical powers of enzymes, but the study of these classes of matter has only just begun. Living things are found by simple experiment to have powers undreamt of, and who knows what may be behind?"

Recently R. S. Lillie[1] (SCIENCE, 51, 525, 1920) has stressed the importance of physico-chemical investigation of protoplasm, and Alexander Forbes (SCIENCE, 52, 331, 1920) has called for closer cooperation between physicists and biologists in attacking biological problems.

An attempt will be made here to outline certain basic physico-chemical principles which affect the formation, development, growth and reproduction of living things, and to point out how it is possible for variation in some of the factors therein involved to account for important and transmissible variations or mutations in individual organisms.

At the outset let it be stated that no mysterious or special "vital force" will be evoked, but that the well-known forces that control inanimate matter seem quite sufficient for the purpose.

In nature, both animate and inanimate, the following basic factors tend to produce *symmetrical orientation or aggregation:* (1) Crystallization; (2) Diffusion, as in the formation of Liesegang's rings, agate, etc.; (3) Electric or magnetic fields of force; (4) Harmonious vibration as of air, water, etc. We here disregard mere chance and the conscious arrangement by man.

[1] See also Lillie's interesting papers in *Biological Bulletin*, 1917-1919, and *Scientific Monthly*, February, 1922.

The main factors modifying the crystallization of pure substances are: (1) Concentration; (2) Temperature; (3) Pressure; (4) Agitation; (5) The presence of other substances, especially of colloids, which may profoundly modify crystal forms by protective action; (6) Iso-colloidism. Some substances have the power of interfering with their own crystallization, because a portion, which first reaches the colloidal state, then protects the balance.

Deviations from normal crystalline forms produced by the presence of colloids are usually symmetrical, but may not appear crystalline. Changes in the nature or degree of dispersion of the colloid, or in its percentage, mixtures of colloids, variations in salt or H-ion concentration of the solution, must all have an effect on the resultant quasi-crystals. Enzymes may, of course, entirely change the nature of the colloid. The species-specificity of proteins seems to be maintained by degenerating food protein to simpler forms (polypeptids and amino-acids) and then building up the specific proteins from these.

Among the factors influencing diffusion, especially in gels, are the chemical nature and particle size of the gel, and the concentration and nature of the diffusing solution. Liesegang has pointed out that "enzoon," which has been considered to be the fossilized remains of primitive organisms, is due to the phenomenon that bears his name—the rhythmic banding resulting from diffusion in gels. In his chapter on "Growth, Metamorphoses and Development" Bechhold ("Colloids in Biology and Medicine," trans. by J. G. M. Bullowa, p. 252 *et seq.*, D. Van Nostrand Co., 1920) refers to some of the remarkable diffusion figures and osmotic forms produced by F. E. Runge and by Stéphane Leduc, some of which resemble algæ, fungi, seaweed, etc., and even show a cellular microstructure. While pointing out the great differences between these formations and the organized structures they simulate, Bechhold says: "The physical forces which produced these inorganic formations are the same as those which produce the growth and configuration of organized material membranes, osmotic pressure, diffusion."

Differences in diffusion speed mean variations in concentration that may affect the action of the enzymes, for, as T. B. Robertson showed, these may work analytically or synthetically, depending on the concentration.

A preliminary note of this character can not consider all of the points above referred to, and will therefore be limited mainly to a brief discussion of one of the most important factors controlling the form of organisms, namely, *the influence of colloids on crystallization*, and the changes in form that may be expected when the colloids are changed or the crystalizing substances varied.

Perhaps the most familiar instance of modified crystallization is to be found in the delicate frost tracery on window panes, the forms being probably influenced by the glass (itself a colloid) or by substances adsorbed at its surface. The writer has pointed out the powerful influence exerted by colloids such as gelatin, gum arabic and albumin on crystallization (*Kolloid Zeit.*, 4, 86, 1909), and R. E. Liesegang, looking at the question from the opposite standpoint, has described the power of crystalloids to give a form to colloidal jellies (*Kolloid Zeit.*, 7, 96, 1910). It may be said that with different salts or combinations of salts, various colloids or combinations of colloids, and variations in concentrations, temperature and speed of evaporation, will produce characteristic and generally reproducible forms on a microscope slide. A characteristic form of sodium chloride is a four pointed star with fern-like arms which cross at a slight angle.

A few slides made with solutions of common salts such as NaCl, $MgSO_4$, Na_2SO_4, etc., containing from 0.5 to 50 per cent. of gum arabic or gelatin (figured on the basis of the dry salt) will illustrate what is meant. When a drop of the mixed solution is allowed to dry on the slide without cover glass, changes of concentration and temperature occur, giving a field that changes progressively from rim to center of the drop. A solution of one part sodium chloride, one part sodium carbonate (dry) and one tenth part gum arabic or gelatin in ten parts of water, when dried, shows in some part of the field a "flowering plant," with graceful stems and characteristic four-petaled flowers.

To see that a marked change may be produced by modifying the colloidal state of the protective substance, a slide was made with a solution containing egg albumen as the colloid. The solution was then heated until the albumen began to show a milkiness, another slide was made, and after drying was compared with the first unheated specimen. The difference in crystallization is considerable.

Unusual crystalline forms such as spherocrystals and sheaf-like groups which are so often seen in the crystals of substances derived from organisms, are very often consequent upon the protective action of some colloid from which they are not entirely purified. Another curious occurrence must be mentioned here, which may be termed *auto-protection* because it is due to iso-colloidism. Before reaching the ordinary visibly crystalline state, particles of every substance must pass through the colloidal zone, and the particles first reaching that state may interfere with the normal crystallization of the rest. Thus ammonium salts, even without the addition of protective colloids, are prone to assume feathery or fern-like forms. The phenomenon is marked in the oleates and is probably the underlying cause of the formation of myelins, although their formation is fostered by such lipoid protectors as cholestrin. According to J. G. Adami (Harvey Society Lecture, 1906), if certain simple soaps be dissolved by warming on a slide with water and then allowed to cool, they may show upon examination in the polarizing microscope a perfect rain of doubly refracting spherules, which, depending on the nature of the soap, may last for hours or days or else immediately give place to a brilliant white layer of formed crystalline plates. The fluid crystals of O. Lehmann are probably examples of auto-protection, and W. B. Hardy, E. Hatschek and others have described substances which form unstable gels that soon become crystalline.

An indication that the colloidal state is anomalous is given by the fact that, while the sun attracts microscopic particles, and even crystalloidally dispersed particles, it selectively repels colloidally dispersed particles, as in the tails of comets (See J. Alexander, "Colloid Chemistry").

The bio-colloids are so readily affected by salts, H-ion concentration (effective reaction), temperature, actinic (sun's rays) and traumatic (shaking, mechanical injury) effects, that it is more surprising that plants and animals should breed true, than that they should show variations. Therefore, although individuals may be much affected by such changes during their lives, it is evidently a rare occurrence that these changes are registered in the germ plasm by which alone they may be transmitted to offspring. The specificity of the germ plasm is evidently guarded by many factors, among which seem to be selective adsorption and differential diffusion of dissolved substances through its protecting walls or membranes. Nevertheless unusual influences must occasionally change it materially without destroying it, and along this line experiment may be directed. It may be that the germ plasm can be affected through the somatoplasm, as well as by direct means. And of all the variations, in nature only the beneficial changes survive.

With highly developed organisms the complications are enormous. We are just beginning to realize the importance of enzymes, hormones, internal secretions (endocrines), essential "impurities" like the vitamines, iodine and manganese, and the necessity of a sufficient variety of food to include enough of each of the essential amino-acids, outside of mere fat-carbohydrate-protein-calorie figures. Therefore, even if experiments with higher forms of life may yield more numerous results, it may be better to begin with the simpler forms where the results may be more readily traced to their causes. Nor must it be imagined that this will prove an easy matter; for filterable bacteria, invisible in the ordinary microscope and not resolvable by the ultra-microscope if visible in it, whose size is of the order of some of the protein molecules, are still capable of breeding true.

Consideration should be especially given to conditions that are apt to be met with in nature or which may have existed in geologic times. The effect of small quantities of substances such as manganese in plants and iodine in mammals should not be overlooked. Even strong acidity or alkalinity may be produced

by volcanic action or by differential diffusion in the earth or in unorganized matter. The slime of some snails carries as much as three per cent. of free sulphuric acid. Temperature, light, water and CO_2 are potent factors.

While the actual experimental work is largely the province of biologists, they will gain much both in direction and interpretation by close consultation with the chemists and physicists.

JEROME ALEXANDER

RIDGEFIELD, CONN.

SCIENTIFIC EVENTS

ANIMAL EXPERIMENTS IN GREAT BRITAIN[1]

THE annual return showing the number and nature of experiments on living animals during the year 1921 gives a list of all "registered places" where such experiments may be performed, the names of all persons who hold licenses during 1921, together with the registered place for which the license was in force and the number and nature of experiments performed. In the year 1921 twenty new places were registered for the performance of experiments and thirteen places were removed from the register. The total number of licensees was 812, of whom 219 performed no experiments. The experiments may be divided into two main groups, according to whether or not an anesthetic was used. It should be noted that the granting of a license only permits the licensee to perform experiments under an anesthetic, for the law declares "the animal must, during the whole of the experiment, be under the influence of some anesthetic of sufficient power to prevent the animal feeling pain; and the animal must, if the pain is likely to continue after the effect of the anesthetic has ceased, or if any serious injury has been inflicted on the animal, be killed before it recovers from the influence of the anesthetic which has been administered." To perform other experiments or even to observe the subsequent course of experiments undertaken with an anesthetic the licensee must be possessed of special certificates. Special certificates are also necessary for experiments on dogs, cats, horses, asses, mules and other large animals. The total number of experiments with anesthetics was 8,165, and of these 2,053 were simple inoculations into the skin of guinea-pigs, which were anesthetized in order to keep the animals motionless during the introduction of a minute quantity of the fluid to be tested for the purpose of standardization. Of the remaining 6,112 experiments, comprising all the cases in which any serious operation was involved, 2,751 were performed under the license alone, and were subject therefore to the restrictions above mentioned. In all operations, with the exception of a few special cases dealing with the efficiency of antiseptics, the law demands that the operation shall be performed antiseptically so that the healing of wounds shall, as far as possible, take place without pain. If the antiseptic precautions fail, and suppuration occurs, the animal must be killed. The following "pain condition" is attached to the license under special certificates: "If an animal, after and by reason of the said experiments, is found to be suffering pain which is either severe or is likely to endure, and if the main result of the experiment has been attained, the animal shall forthwith be painlessly killed. If an animal, after and by reason of the said experiments, is found to be suffering severe pain which is likely to endure, such animal shall forthwith be painlessly killed, whether the main result of the experiment has been attained or not. If any animal appears to an inspector to be suffering considerable pain, and if the inspector directs such animal to be destroyed, it shall forthwith be painlessly killed." The total number of experiments without anesthetics was 67,097. These were mostly simple inoculations and hypodermic injections, but included also some feeding experiments and administration of various substances by the mouth or by inhalation or by external application, and the abstraction of blood by puncture or simple venesection. In no instance was a certificate dispensing with the use of anesthetics allowed for an experiment involving a serious operation. The total number of experiments was 75,262, being 4,895 more than in 1920. The objects for which these experiments were performed were very diverse. A large number, almost wholly simple inoculations, were performed either on behalf of official bodies, with a view to the preservation of the public health or directly for

[1] *The British Medical Journal.*

the diagnosis and treatment of disease. Experiments conducted at a sewage farm to test the character of the effluent by its effect on the health of fish is an example of work carried out for the preservation of public health. Nearly 20,000 experiments were performed for the preparation and testing of antitoxin serums and vaccines and for the testing and standardizing of drugs. The several registered places were visited frequently by the inspectors, usually without previous notice, and they report that the animals were suitably lodged and well cared for, and the licensees generally attentive to the requirements of the act and the conditions attached to their licenses.

THE REPORT OF THE ENGINEERING COUNCIL ON WORK PERIODS

"THE tendency throughout the world is toward the abolition of the twelve-hour shift," it is held by the report of the Committee on Work-Periods of the American Engineering Council of the Federated American Engineering Societies, which has been adopted after a long discussion by the executive board of the council in Boston. The report, in effect, finds that the two-shift day of twelve hours each is not an economic necessity in American industry.

"In almost every continuous industry," according to the report, "there are plants which are operating on an eight-hour shift basis in competition with twelve-hour shift plants." It is also shown that in practically all major continuous industry plants which have changed from twelve hours to eight hours have increased the quantity of production per man up to as much as twenty-five per cent. In a few cases, the report states, the increase has been much higher. In the steel and iron industry, which is made the subject of a special report, it was found that "the change from the twelve to the eight-hour day has secured results sufficient to compensate in whole or in part for the extra cost."

Other advantages of the eight-hour day in the steel and iron industry are described as increased efficiency, better morale, elimination of the "floating gang," which is maintained to give twelve-hour men a day off a week, and greater prestige of the industry with the public.

Professor Samuel McCune Lindsay, of Columbia University, representing the Cabot Fund of Boston, officialy styled the report as embodying the results of "the most important investigation of any industrial situation ever undertaken in this country." The Cabot Fund cooperated in the engineering investigation, which occupied nearly two years and covered practically every continuous industry in the United States. Professor Lindsay, who is president of the Academy of Political Science, authorized the statement that Professor Henry R. Seager, of Columbia, president of the American Economic Association, shared his general view.

The results of the industrial investigation, which will exercise a great influence on the general labor situation, were obtained through two lines of inquiry. One enquiry, embracing the steel and iron industry of the country, was directed by Bradley Stoughton, of New York, former secretary of the American Institute of Mining and Metallurgical Engineers and former adjunct professor of metallurgy in Columbia University.

The second enquiry was directed by Horace B. Drury, industrial investigator and former member of the faculty of Ohio State University. Each enquiry was made the subject of a separate report, the whole investigation being in charge of the council's Committee on Work-Periods, of which Dr. H. E. Howe, of Washington, is chairman. Dr. Howe presented the report to the board. His associates on the committee are J. Parke Channing, L. P. Alford, Fred J. Miller and Dwight T. Farnham, of New York; Morris L. Cooke, of Philadelphia, and L. W. Wallace, of Washington.

Presentation of the report by Dr. Howe caused a spirited discussion of two hours, during which President Cooley, urging adoption, asserted that the report was a remarkable contribution of the engineering profession toward the advancement of mankind. Others participating in the debate were Philip N. Moore, of St. Louis; Professor Joseph W. Roe, of New York University; Irving E. Moulthrop, of Boston; W. W. Varney, of Cleveland; Calvert Townley, of New York; E. S. Carman, of Cleveland; John A. Stevens, of Lowell; Wil-

liam Rolfe, of St. Louis, and Messrs. Channing, Alford and Wallace, representing the Committee on Work-Periods. The report was finally adopted by an overwhelming vote.

The Drury report was described as a general survey of all industries operating continuously twenty-four hours a day. The leading continuous industries investigated are divided into four groups as follows:

Group I: Iron and steel, non-ferrous metals, glass, Portland cement, lime, brick and pottery.

Group II: Heavy chemicals, fertilizers, explosives, dyes, industrial alcohol, wood distillation, refined corn products, soap, glue, drugs, etc., electro-chemical industries, sugar, table salt, petroleum, cottonseed oil and other oils.

Group III: Paper, flour, rubber, breakfast foods, automobiles, textiles and mines.

Group IV: Power, gas, water supply, ice, shipping, railroads, street railways, telegraph and telephone, mails and express, policemen, firemen and watchmen.

SCIENCE SECTION OF THE ASSOCIATION OF COLLEGES AND PREPARATORY SCHOOLS OF THE MIDDLE STATES AND MARYLAND

AT the annual meeting of the Association of Colleges and Preparatory Schools of the Middle States and Maryland held at Swarthmore College on November 26, 1921, Science Section was organized. Dr. Bertha M. Clark, William Penn High School, Philadelphia, presided at the organization meeting. A constitution prepared by a committee consisting of Dr. H. J. Creighton, Swarthmore; Dr. James Barnes, Bryn Mawr; Dr. Ida A. Keller, Philadelphia High School for Girls; Dr. W. B. Meldrum, Haverford; and Dr. R. H. True, University of Pennsylvania, was presented and adopted by unanimous vote.

According to its constitution the Science Section has been organized to bring about active cooperation between the colleges and preparatory schools in improving the teaching of science. The following officers were elected to serve one year:

President: Dr. Thomas D. Cope, Randal Morgan Laboratory of Physics, University of Pennsylvania.

Vice-president: Mr. Charles E. Dull, South Side High School, Newark, N. J.

Secretary: Miss Margaretta Atkinson, Philadelphia High School for Girls.

Treasurer: Dr. Walter Steckbeck, Macfarlane Hall of Botany, University of Pennsylvania.

The following councillors were elected to serve two years:

Dr. Gellert Alleman, Swarthmore College.

Dr. Bertha M. Clark, William Penn High School, Philadelphia.

Dr. Raymond Brownlee, Stuyvesant High School, New York City.

The council has decided to hold the next meeting of the section at the time of the next annual meeting of the Association of Colleges and Preparatory Schools. This meeting will be held at the Tower Hill School, Wilmington, Delaware, during the Thanksgiving recess in 1922. An attractive program is being prepared and plans are being made to increase materially the membership of the section. Due announcement of the program will be made public.

HERSCHEL CENTENARY PILGRIMAGE[1]

THE centenary of the death of Sir William Herschel, the first president of the Royal Astronomical Society, was commemorated on August 25 at Slough, where he lived and carried out so much memorable work. The Royal Astronomical Society, with Sir F. Dyson, the astronomer royal, made a pilgrimage to the chief places associated with Herschel's history, and were welcomed by the chairman (Mr. E. T. Bowyer) and other members of the District Council of Slough, and representatives of the Herschel family, in whose occupation the astronomer's house—Observatory House—still remains.

The first place to be visited was Old Upton Church, a competitor with Stoke Poges for the honor of having inspired Gray's *Elegy*. Herschel's body lies beneath the flags of the ancient chancel, on which there rested a star-shaped wreath of flowers. The church register records the date of his marriage with "Mary Pitt, widow, of this parish," May 8, 1788, and the baptism of his only son, John Frederick Wil-

[1] The London *Times*.

liam, who was afterwards also to contribute to the astronomical fame of the family. An old thatched barn, which Herschel used as a workshop, was visited next, and the party afterwards went through Upton Court, where his wife's first husband, John Pitt, lived. It belongs to Lord Harewood, and has been for some time untenanted. In the afternoon the visitors were welcomed to Observatory House by Miss Herschel. There they saw many interesting personal relics—some in the house itself, some in an adjoining cottage which has been made into a little museum, and some in the garden. Against the back wall of the garden, embowered in foliage, rests a section of Herschel's great telescope, 10 feet or 12 feet in length. A circular ridge on the lawn marks the place where the telescope formerly stood. In the hall of the house is one of two mirrors which were cast for the big telescope. The mirror and tube of the smaller telescope which Sir John Herschel took to the Cape to survey the heavens of the southern hemisphere were also shown.

At luncheon, which was served at the Old Crown Hotel, at one time part of the property of Sir William Herschel, the Reverend Sir John Herschel said that the great work of Sir William Herschel at Slough was his investigation of the structure of the heavens. He put forward the view that the whole visible universe was like a couple of soup-plates put face to face. That theory, he believed, still held the field. Another great discovery was that of nebulæ. Herschel at first thought they could be resolved into separate stars, but afterwards came to the conclusion that in certain cases these dull, fuzzy things were a shining fluid. That some of the nebulæ were resolvable into stars was proved later by Lord Rosse, and the hypothesis of the shining fluid was confirmed many years later by Huggins. Sir William Herschel was much before his age in his speculations. Though they fell into discredit for a time, he had since come into his own again and had been found to have made very few mistakes.

Sir Frank Dyson said he thought what Sir J. Herschel had said about Sir William Herschel was true. He was undoubtedly a very great man. In addition to the wish to fathom the heavens, he had the great mechanical and engineering skill which enabled him to make his telescopes. He had also the prodigious enthusiasm and energy needed to carry out his big surveys.

Dr. Dreyer added further instances of Sir William Herschel's clear insight. About the year 1785 he announced that the sun was traveling through space towards the constellation Hercules. Though the evidence was perhaps slender at the time, and nobody, he believed, took serious notice of the matter, the discovery was undoubted. He also first suggested the "grindstone theory" of the Milky Way—that there was a great layer of stars between two parallel planes.

THE INTERNATIONAL GEOLOGICAL CONGRESS

THE twelfth International Geological Congress was held in Belgium during the month of August with a large and influential delegation of some 500 geologists from all parts of the word, except former enemy countries. A number of geological excursions were organized covering the most interesting sections of Belgium, to which a large number subscribed. France was well represented by men like de Margerie, Lacroix, Gentil, Kilian, Bigot Lory, Haug, Cayeux, Fallot, Yung and others; while Switzerland had sent Lugeon and Argand, both masters of tectonics. Especially interesting was Argand's lecture on "The Tectonics of Asia," illustrated with a tectonic map of the Eurasian continent which no doubt marks an epoch in structural geology. This synthetic and clever graph of the Eurasian continent contained more than 3,500 geological sections, transferred in tectonic form and colors on the map which served to illustrate the opening public lecture of the congress.

Spain was well represented, and Director Cesar Rubio, of the Instituto Geologica de España, with a goodly contingent of geologists from the Iberian Peninsula, took part in the congress. The invitation given by Spain was accepted, so that the fourteenth International Congress of Geology is to be called for 1925 in Spain.

A large number of United States geologists attended the congress. Dr. David White, chief geologist of the U. S. Geological Survey, was

there, representing the United States government and survey. Dr. R. A. F. Penrose, Jr., of Philadelphia, was also an official representative of the United States government, whilst Professor N. H. Winchell, ex-president of the American Institute of Mining and Metalurgical Engineers, was also an official delegate. Professors S. B. Matthews and W. H. Emmons, Dr. Quirke, Professor G. F. Cleland, E. O. Ulrich and many others took part in the meetings.

Dr. Frank Darwin Adams, of McGill University, president of the twelfth congress held in 1913 in Canada; Dr. Charles Causell, of Ottawa, deputy minister of mines; Dr. Reginald W. Brock, of Vancouver; Professors Coleman, T. L. Walker and W. A. Parker, of the University of Toronto; Professor E. M. Baker, of Queen's University, and the writer represented the Royal Society of Canada.

Great Britain, Italy, Poland, Czecho-Slovakia, Roumania, Denmark, Mexico, Argentina, Brazil, New Zealand, Australia, West Africa, Egypt and India were represented.

The tectonics of Africa formed one of the principal topics and what was formerly styled the dark continent is now supplying some of the brightest pages in our knowledge of the crust of the earth.

The consolidation or drafting of a constitution for the International Geological Congress occupied the attention of a number of European and American geologists, and, finally, at the last general meeting the statutes as discussed in council and approved by it were adopted with one dissenting vote.

H. M. A.

SCIENTIFIC NOTES AND NEWS

DR. ALEXANDER SMITH, formerly professor of chemistry at the University of Chicago and Columbia University, has died at Edinburgh at the age of fifty-six years.

PRESIDENT LIVINGSTON FARRAND, of Cornell University, has accepted an invitation to deliver an address at a joint meeting of the American Association for the Advancement of Science and the Society of the Sigma Xi to be held at the Boston convocation week meeting.

DR. HIRAM BINGHAM, professor of Latin-American history at Yale University, has been nominated by the Republican state convention of Connecticut for the office of lieutenant governor.

A CABLE message to the American Society of Mechanical Engineers announces the election by the engineers of Holland to honorary membership in the Koninkljik Instituut van Ingenieurs of Mr. Calvin W. Rice, secretary of the society. Mr. Rice is now in Rio de Janeiro as the representative of American engineering societies at the International Engineering Congress.

MR. JESSE MERRICK SMITH, of New York, has been elected by the American Society of Mechanical Engineers delegate to the seventy-fifth anniversary of the Dutch Engineering Institute, with Mr. Hosea Webster, of New York, as alternate.

ON the occasion of the annual dinner of the Royal Society of Medicine, presided over by Sir John Bland-Sutton, the Jenner Memorial Medal was presented to Dr. John C. McVail.

PROFESSOR RAFAELE ISSEL has been appointed director of the biological work of the Italian government on the Adriatic. This work will now be concentrated at Rovigno.

DR. ERNEST B. FORBES has been appointed director of the Institute of Animal Nutrition at Pennsylvania State College to succeed the late Dr. Henry Prentiss Armsby. Dr. Forbes is specialist in nutrition in the Institution of American Meat Packers of Chicago, and was for thirteen years chief of the department of nutrition of the Ohio State Agricultural Experiment Station.

LILLIAN SEGAL KOPELOFF has been appointed in charge of the newly established research department of biological chemistry at the Psychiatric Institute of the New York State Hospitals, Ward's Island, New York City.

MR. H. K. CUMMINGS has resigned an instructorship in mathematics at Brown University to accept a position in the Bureau of Standards at Washington.

PROFESSOR L. WINFIELD WEBB, professor of psychology, has been named by President

Walter Dill Scott as director of the mental alertness tests which will be made by Northwestern University on the 1,000 freshmen that are expected to register during the week beginning on September 18.

THE auxiliary schooner *Bowdoin*, bringing back to their starting point Donald B. MacMillan and the members of his Arctic expedition, was anchored on September 11 at Mohegan Island. Mr. MacMillan has announced that the expedition, which spent fourteen months exploring Baffin Land, proved that all maps of Baffin Land, were largely guesswork. G. Dawson Howell, of Boston, has remained behind to cruise around Hudson Bay to continue his observations in terrestrial magnetism for the Carnigie Institution. He expects to reach St. John's, N. F., about October 1.

PROFESSOR F. L. WASHBURN, of the University of Minnesota, accompanied by Mr. Cadwallader Washburn, sailed on the SS. *Tahiti* on September 8 for Tahiti and other South Sea islands. Professor Washburn is on sabbatical leave and will make a collection of insects for the university. Mr. Cadwallader Washburn, of New York and Mexico, expects, in addition to adding to his collection of canvases, to secure a representative collection of the eggs of birds found in the Marquesas Islands for the Museum of Comparative Oology of Santa Barbara, California.

A SPECIAL PRESS telegram to the London *Times* from Professor J. W. Gregory, of Glasgow University, reports his safe arrival at Talisu [? Talifu, Yunnan] after a successful journey in Tibet. Professor Gregory left at the end of March last on an expedition which had for its object the exploration of the mountain ranges of southwest China, and to make geological, zoological and botanical collections, specimens of which Professor Gregory intended to distribute between London and Glasgow museums. Professor Gregory and his son, Mr. Christopher Gregory (who was to act as surveyor), were to be the only Europeans in the party, the intention being to rely upon the services of a Chinese escort.

MISS ALICE H. ARMSTRONG, assistant chief of the radium section of the Bureau of Standards, will be absent from the bureau during the current academic year, pursuing special studies at Harvard University.

IOWA STATE COLLEGE has granted Associate Professor J. T. Colpitts of the department of mathematics leave of absence for the coming year to study at Cornell University, and Assistant Professor E. C. Kiefer leave of absence to study at the University of Michigan.

DR. HERMANCE MULLEMEISTER, of the University of Washington, has been granted a year's leave of absence to study mathematics in Holland.

THE French delegation sent to Rio de Janeiro for the celebration of the centenary of Brazilian independence comprises, among others, Dr. Pierre Janet, professor of the Collège de France, and Dr. Georges Dumas, professor of experimental psychology at the Sorbonne.

DR. CHARLES K. CLARKE, medical director of the Canadian National Committee for Mental Hygiene, and professor of psychiatry at the University of Toronto, has been asked to deliver the Maudsley lecture on psychiatry at the congress of the British Medico-Psychological Association in London in 1923.

DR. ANTON DAVID UDDEN, instructor in physics in the University of Pennsylvania, during the last year McFadden fellow of the American-Scandinavian Foundation, studying with Professor Bohr in the University of Copenhagen, died in San Antonio, Texas, on September 5, at the age of thirty-five years.

DR. JUAN SANTOS FERNÁNDEZ, the ophthalmologist and hygienist of Cuba, has died at the age of seventy-five years. His seventieth birthday was celebrated at Havana in 1917 with great ceremony, and a gold medal was presented to him with many tributes.

THE death is announced of Dr. Juan Guglielmetti, a leader in experimental medicine and instructor in physiology at the University of Buenos Aires, and professor at La Plata, aged thirty-three years.

THE American Petroleum Institute has called a general conference of the transportation and mechanical sections of the oil industry, to be held at the Statler Hotel, St. Louis, September

27. One of the subjects which will be under discussion is the rail transportation of petroleum and its products.

THE *Journal* of the American Medical Association states that the convention of the German Botanical Society and of the German Society for the Study of Heredity will be held in Vienna this month. The two societies have agreed to unite for the present sessions. A large number of papers will be presented, and representatives from Sweden, Switzerland, the United States, Norway, Italy and Czecho-Slovakia have already announced their intention to be present. Special attention centers in the proceedings of the German Society for the Study of Heredity, as reports on the latest achievements in this line will be made by Goldschmidt (Berlin), on the problem of mutation; Spemann (Freiburg), on the activation of the heredity-mass, and Rüdin (Munich), on the hereditary transmission of mental disturbances. Professor Wettstein will preside over the joint meeting.

WE learn from the *Journal of Industrial and Engineering Chemistry* that the Public Health Institute of Chicago has undertaken to finance the cooperative research between the University of Wisconsin Medical School and the chemical department of Northwestern University, which in the past has been supported by appropriations from the United States Interdepartmental Social Hygiene Board. This research which has been devoted to attempts to improve the treatment of syphilis of the central nervous system has been directed by Dr. W. Lee Lewis and Dr. F. C. Whitmore, of Northwestern University, and Dr. A. S. Lovenhart and Dr. W. F. Lorenz, of the University of Wisconsin. The Public Health Institute has appropriated $21,600 for the use of both universities during the coming year.

FOLLOWING the receipt of a message from M. Mowatt, of London, secretary of the British Institution of Mechanical Engineers, Charles F. Rand, chairman of the Engineering Foundation, has announced that the leading engineering societies of England have formed the Engineering Joint Council, to work with engineers of the United States and of Canada and other British possessions toward concerted action for world peace and the advancement of engineering ideals "for the good of mankind." Mr. Rand described the organization of British engineering bodies into a single unit as a step in the movement to form a world union of engineers, which already has gained headway in France, Italy and Czecho-Slovakia, direct contacts having been established by the engineering bodies of these countries with those of America. The organizations represented on the British council include the British Institution of Civil Engineers, Institution of Mechanical Engineers, Institution of Naval Architects and the Institution of Electrical Engineers. Coincident with Mr. Rand's announcement, Dean Mortimer E. Cooley, of the University of Michigan, announced that the Federated American Engineering Societies, of which he is president, has appointed a committee on affiliation with engineering societies outside of the United States. The chairman is Gardner S. Williams, of Ann Arbor, a former member of the Michigan faculty.

A REUTER'S dispatch states that members of the Mount Everest Expedition have sent the Pope a fragment of rock taken from the highest point reached by them on the mountain. The fragment has been mounted on an ebony stand decorated with silver and having a carved dedication to the pontiff, who is himself an alpine climber of no mean prowess. The pope has sent General Bruce, the leader of the expedition, the golden medal of his pontificate, together with an autograph letter of thanks. In this he recalled that when he was elected pope the Everest Expedition, which had already begun the ascent, sent him a telegram of congratulation and good wishes addressed to "the Alpinist Pope."

THE Province of Quebec has purchased from the U. S. Radium Corporation one gram of radium, valued at $100,000, for the use of its citizens in the treatment of cancer and other malignant diseases. The radium will be sent to the University of Montreal, where, under the supervision of Dr. J. A. Gendreau, it will be at the service of the people of Quebec Province.

A DISPATCH from *The Pas,* in Northern Manitoba, as reported in the London *Times,* says that Mr. Alfred Tremblay, Arctic ex-

plorer, with his party, is leaving shortly for Hudson Bay, whence he will journey to the Arctic Seas and continue his investigations in Baffin Land and at the Magnetic Pole. Mr. Tremblay was a member of Captain Bernier's Arctic expeditions of 1910-11, 1912-13. He was only nineteen years of age when he made his first trip into the north. On his last expedition he succeeded where several well-equipped expeditions had failed in reaching Igloolik and Fury and Hecla Strait for the first time since the visit in 1822-23 of Sir E. W. Parry. Mr. Tremblay covered over four thousand miles on foot in the depth of winter and afterwards, with the assistance of Mr. A. B. Reader, a native of New Zealand, mapped and re-mapped some three thousand miles of coast-line. He was the first white man to cross land from the head of Admiralty Sound to Fury and Hecla Strait and to make the long and dangerous crossing from Murray Maxwell Bay, across Cockburn Land to Milne Inlet. Mr. Tremblay is accompanied on this expedition by Messrs. Arthur Barbeau and C. Talbot, all being natives of Quebec. Hudson Bay will be followed to Fox Channel, whence the party will proceed along the northwest side of Baffin Land. After carrying out surveys and general exploration of the areas of Baffin Land which he did not examine on his last trip, he will proceed to the Magnetic Pole to take observations. Mr. Tremblay's party will be the first to attempt the journey which it is undertaking by canoe and on foot. His trip will occupy approximately two years.

THE Paris correspondent of the London *Times* writes that in its annual report, recently published, the Compagnie Nationale des Matières Colorantes, which was founded five years ago with government encouragement to guarantee the supply of dyestuffs to French industries, confesses its dependence upon the experience and assistance of its foreign competitors. The report says: "The work of even the best technicians must be sterile unless they are in possession of all the knowledge accumulated in the past—knowledge which is essential to success. All who understand the complexity of the manufacture of organic coloring matters will realize why we have been compelled to acquire the patents, the processes and the technical aid of our principal foreign competitors for exclusive use in France. Thus we have had at our disposal the results of fifty years of investigation, and processes minutely studied and methodically put into practice, and so we are immediately placed in a position equal to that of the most modern and most specialized firms in our industry." Certain sections of the French press affect to perceive in this statement confirmation of a rumor long in circulation that the Compagnie Nationale has entered into an alliance with its German rivals. It is recalled that not long ago the *Chemiker Zeitung* announced that an agreement had been entered into between the German and French dye industries, in which seven great German firms and the Compagnie Nationale des Matières Colorantes were associated, by which the German firms were to give the French company detailed technical assistance and full information concerning the processes of manufacture and to supply German chemists to supervise the application of the processes in French dye works. In return, it was stated, the Compagnie Nationale undertook to limit supplies of certain synthetic dye-stuffs to France and her colonies, and to allow the German firms a share of the profits.

Nature announces that proposals for closer cooperation amongst the leading British engineering institutions, which have recently been under consideration, have now received the approval of the institutions, the representatives of which met in conference, namely, The Institution of Civil Engineers, The Institution of Mechanical Engineers, the Institution of Naval Architects, and The Institution of Electrical Engineers, and that an engineering joint council composed of representatives of these bodies has been formed. Among the objects of the joint council will be, to improve the status of engineers, to secure the better utilization of their services in the country's interests and the appointment of properly qualified individuals to responsible engineering positions, and to prevent the unnecessary duplication of activities. It is anticipated that, at a later stage, the number of bodies represented on the joint council may be increased, but this at present

remains a matter for future consideration for the joint council and the institutions concerned.

THE medical correspondent of the London *Times* writes as follows: "It is worth noting that whereas the death rate in 1851-1860 was 3,841 per million (all forms of tuberculosis), it was only 1,352 per million in 1913. During the war there was an increase, but in 1919 a sharp fall occurred to a figure lower than any previously recorded. This fall continued in 1920; in 1921, taking into consideration the increase of population, the position was again satisfactory, though a slight increase over 1920 was recorded. This slight increase was almost negligible in males (from 998 to 1,002 per million), but in females it was more appreciable (756 to 777 per million). Both the number of deaths and the death rates for non-pulmonary tuberculosis were lower in 1921 than in 1920. Sir George Newman asks whether this slight check to the fall in the mortality of pulmonary tuberculosis bears any relation to the large amount of unemployment in 1920. It may well do so, for tuberculosis flourishes in conditions of malnutrition and poverty. In Germany, for example, the tuberculosis death rate increased from 1914 onwards until, in 1916, it was double the pre-war rate. In 1917 it was still higher. In 1918 there were 40,000 more deaths in Germany from tuberculosis than in 1913. A similar state of matters has been reported from Poland, where in 1917, in Warsaw, four out of every hundred persons were said to have died from this cause. The mortality decreased from the date of the departure of the German army and the cancelling of the rigorous food restrictions. These facts are of great importance. They tend to confirm the view that our gradual deliverance from this scourge is due to better feeding.

UNIVERSITY AND EDUCATIONAL NOTES

THE will of the late Mrs. Harriet L. Cramer, widow of the late owner of the *Evening Wisconsin*, leaves $100,000 to the arts and science department of Marquette University and approximately $1,000,000 to Marquette University Medical School. This is the second million that the medical department of Marquette University has received in the past four years.

THE Kyushu Imperial University, Fukuoka, Japan, has recently opened the departments of medicine and engineering to women students. Women are barred from attending the University of Tokyo.

DR. ARTHUR GRISWOLD CRANE has been elected president of the University of Wyoming to succeed Dr. Aven Nelson, president since 1917 and previously professor of botany. Dr. Crane was major in the Sanitary Corps during the war.

THE REVEREND ALBERT C. FOX, S.J., former president of Campion College, at Prairie du Chien, Wisconsin, has been appointed president of Marquette University, succeeding the Reverend Herbert C. Noonan, S.J. Father Noonan assumes other administrative work in the Missouri province of the Jesuit Order.

DR. WILLIAM C. ROSE, professor of biological chemistry at the medical school of the University of Texas, has been appointed professor of physiological chemistry at the University of Illinois.

DR. HOWARD BISHOP LEWIS, instructor of physiological chemistry at the University of Michigan Medical School, has been appointed to a chair of physiology at the university.

ASSISTANT PROFESSOR R. B. ROBBINS will return to the University of Michigan after two years' absence in actuarial work in the departments of insurance of Missouri and New York.

AT the University of Colorado, Assistant Professor G. H. Light has been promoted to a full professorship of mathematics and Dr. Claribel Kendall to an assistant professorship.

DISCUSSION AND CORRESPONDENCE

TINGITIDÆ OR TINGIDÆ

THE proper form to be used as the family-name for the Lace-bugs (*Hemiptera*) has been the subject of considerable correspondence between Professor Carl J. Drake and the writer of these lines.

The generic name *Tingis* was first employed

in the *Hemiptera* by Fabricius ("Systema Rhyngotorum," 1803, p. 124). Fabricius named a number of genera in the Hemiptera employing ancient Greek names of cities, from which the insects which he was describing had, no doubt, come. *Tingis* is the Greek name of Tangiers in Morocco. It is also spelled by classic authors *Tingi* and sometimes *Tinge*. Strabo in his Geography, Part 1, 3, 1, § 140, speaks of Τῖγγος and uses the genitive form Τῖγγιος. This shows that the root or stem of the word is Τῖγγι = *Tingi*. The adjectival form derived from the noun *Tingis* in Latin is *Tingitanus*. (*Cf.* Valpy's edition of the Delphin Classics, Vol. No. LXXXIX, p. 882, where comment is made upon the passage in Pliny's *Historia Naturalis*, Lib. V, 1, 1: *"Tingitana pertinet a freto Gaditano ad fines usque Marocani regni."* This adjectival form plainly indicates that the Latin root of the noun is *Tingit*.

In forming family names the fixed rule is to suffix *"idæ"* to the stem, and it is the rule that the Latinized form of Greek words should be employed. The Latin stem, as shown above, of the ancient name of Tangiers is "Tingit." Adding *"idæ"* to this we have the word *Tingitidæ*. The Greek stem, if the Latin is overlooked, is Τῖγγι = *Tingi*. Suffixing *"idæ"* to this we should have form *Tingiidæ*, which has never been used.

The first time that a family name was given to the Lace-bugs was in 1833 when Laporte employed the term *Tingidites* (*Gallicism*). Westwood in 1840 used the word *"Tingidæ."* Amyot and Serville in 1843 employed the Gallicized form *Tingides;* Stål in 1873 employed the form *Tingitidæ* and was followed by Uhler, Champion, Horvath, Oshanin, Osborn, Drake and a number of others. Then Duzee in 1917 in his "Catalogue of the Hemiptera of America North of Mexico" employed *"Tingididæ"* as the family name, citing Laporte as his authority.

The writer of these lines having regard to etymology and the rules governing the construction of family-names is decidedly of the opinion that *"Tingitidæ"* is the correct form of the word, formed as it is by suffixing *"idæ"* to the Latin stem *Tingit*. Westwood's *"Tingidæ"* is in error, *first* because had he studied the classic Greek he would have discovered that the root is not *Ting* but *Tingi;* and *secondly,* because he did not follow the rule which calls for the employment of the Latinized form of the word. *Tingididæ* as used by Van Duzee is wholly in error, based, as it is, upon the mistake of Laporte who imagined that the genitive of *Tingis* was Τῖγγιδος, instead of Τῖγγιος as given by Strabo.

The conclusion of the matter in the mind of the writer is that the word *Tingitidæ* is not merely formed according to the requirements of scientific nomenclature, but according to classic use. It furthermore has in its favor the weight of authority, having been used by a number of eminent gentlemen, distinguished not merely for their entomological but for their philological attainments. They have already been mentioned. The question of priority can not be invoked as against the correct structure of language.

W. J. HOLLAND

CARNEGIE MUSEUM,
AUGUST 2, 1922

THE GLACIATION OF THE CORDILLERAN REGION

TO THE EDITOR OF SCIENCE: Because of general interest in the subject of glaciation in the Cordilleran region and of recent discussion in SCIENCE of the origin of the Palouse soils the investigation of the writer in the twelve-months past in the region about Spokane, Washington, may merit the attention of your readers.

The investigation began with discovery of evidence of glaciation on the basalt plateau about Spokane some four or five hundred feet above the train of the valley glacier in Spokane Valley (described and mapped by Campbell, N. P. R. R. Guide-book of the U. S. Geol-Survey, 1916). Examination proved that all of these "prairies" (Pleasant Prairie, Five Mile Prairie, Sunset Prairie, Moran Prairie and Paradise Prairie) occupying this plateau bore evidence in the form of erratic boulders, gravel, sand and clay, of depths varying from nothing to fifteen feet or more, of ground ice on the level tops of the plateaux. In the valley of

Hangman Creek (Latah Cr.) in the southwest part of the city deposits are five or six hundred feet deep, the valley having been filled (as, presumably, was also the valley of Spokane River). As no evidence was found of the glacier having crossed the Spokane River to the east of the city limits and as what appeared to be a marginal moraine was found on the south side of the valley at the southeast corner of the corporation boundary (Pantops) it seemed that the valley of the Spokane must have been completely dammed, impounding the waters of the entire Columbia drainage basin. It was believed that such a volume of water even in a brief time must have cut an outlet which would be readily found. Such was found to be the case. In the gap between Mica Peak and Moran Peak, at the village of Mica, on the O. W. R. & N. Railway, twelve miles southeast of Spokane, at an elevation of about 2,460 feet, two outlets may be easily seen in the field or by examination of the topographic sheet of Spokane Quadrangle of the U. S. Geological map. These two streams join California Creek a short distance south of Mica and follow it to Hangman Creek (Latah Cr.). Apparently Hangman Creek was obstructed here also for the stream followed up Hangman Creek (Oakesdale Quadrangle) until it reached what is now the low land between Hangman Creek and the head of North Pine Creek, where it cut a channel some 200 feet in depth in the Palouse soil of that region, reaching and scouring the basalt beneath, thus opening an outlet to the southwest.

This glaciation was followed by a period when stream erosion cleared the valleys of Spokane River and Hangman Creek and perhaps eroded Spokane Valley almost 200 feet below the present floor (left at the time of the Wisconsin period of glaciation) as shown by the depth of Lake Cœur d'Alene and other lakes which occupy side branches of Spokane Valley. There is also some evidence collected of a glacier having almost reached Spokane from the north by way of the valley of the Little Spokane River. As this is about 400 feet lower than the glaciation on the "prairies" and extends some twenty miles south of what seems to be the terminal moraine of the Wisconsin period (the Wisconsin glaciation reaching Spokane came from the east), it will be seen that we have evidence of three periods of glaciation here. The earliest of these is responsible for "Lake Spokane"[1] and its Mica outlet by way of California, Hangman and North Pine Creeks.

It will be seen from this that a long period has elapsed since the cutting of this great trench through this soil and as yet the æolian deposits have not covered the bare rocks of its floor, though for eight miles between North Pine Creek and Hangman Creek there is no stream sufficient to account for removal of deposits.

(Mr. J. T. Pardee of the U. S. Geological Survey spent six weeks of May and June of this year making a careful study of glaciation and related subjects in northeast Washington and has secured data for what promises to be the most interesting of all recent reports on this subject. The appearance of his report is awaited with great interest. The writer is collecting further material on the shore line of L. Spokane and on the glaciation in Little Spokane Valley.)

THOMAS LARGE
THE LEWIS AND CLARK HIGH SCHOOL,
SPOKANE, WASHINGTON

A SUGGESTION TO ZOOGEOGRAPHERS

Ranges of animals are most easily defined in terms of political divisions, cities near the limit of range, and such readily determinable points. This eminently practical method will doubtless always be used.

But ordinarily zoogeographers have not been content to use only this method, which, from its nature, explains nothing, and questions nothing.

There has been a constant search for some sort of scheme whereby ranges of animals might be reduced to a common denominator. Various schemes of this kind are in use at present and hereinafter shall be commented upon.

[1] The name "Lake Spokane" was given by the writer in a paper on "Glaciation and Vulcanism in the Spokane Region" read on November 3, 1921, before the Columbia Section of the American Institute of Mining and Metallurgical Engineers.

By far the most generally used of these philosophical methods is that of Realms, Regions and Zones. These are all based on the idea that large numbers of species have the same range, and that by picking out some of the conspicuous forms and mapping their ranges one has *ipso facto* a set of regions, to which other ranges may be referred, and with which other ranges should agree.

This is, in some degree, true, but in nearly every case in which the ranges of any two species agree, the agreement is due to the geographic factors and not to the zoologic factors.

It is obvious that the zoogeographical realms are nothing save and except the great land masses with lines drawn to correspond to the physiographic barriers. There is a great philosophical difference between such terms as Holarctic Fauna and Holarctic Region. In the first case we speak of zoological matters in terms of zoology, in the second of geographical matters in terms of mythology.

The Palearctic fauna is an aggregate of species and may invade (in fact *has* invaded) Australia without forfeiting its name.

It occupies, in the main, territory distinct from that of any other fauna, and this by virtue of the Sahara and the Himalaya, but in eastern China there is a broad area where Palearctic and Oriental faunas intermingle and where no line can be drawn which would delimit the range of more than a few species.

In Malaysia, Oriental and Australian faunas overlap in the same way. Van Kampen ("The Zoogeography of the East Indian Archipelago," *Amer. Nat.*, XLV, 1911, p. 537-560) has shown that Wallace's famous line is as mythical as the Jack of Diamonds.

All lines of this sort apply primarily to the animal on whose range they are based (and theoretically should be shifted when the range is extended); secondarily to its parasites, commensals, prey, etc.; and thirdly to animals of very similar constitution, origin, or habits.

Where zonal lines coincide with physiographic barriers there is a noticeable change in fauna within a few miles, where there is no barrier there is a broad region wherein each species is a law unto itself.

In no case can the boundary of a faunal zone, as such, be *seen*.

As, in cases where the zonal lines really mean a sudden change in fauna, there is also present a sharp change in topography, and as this topographical change can be *seen* with the greatest ease (and as, in cases where the zonal lines are based on ranges of a few species, and do not indicate a sudden change in fauna, there is no sharp change in topography), it seems high time to cease disputing about zones and to use terms which have some meaning.

The zones are frequently described as being based on temperature and the lines as corresponding to isothermal lines. Apart from the objection that no one can *see* an isothermal line, the temperature measurements for the zones are not the bases on which these areas are delimited, but are merely the temperatures for areas previously delimited by other means.

Once established the zones have persisted in spite of the extensions of the ranges of many animals on which the zones were originally based, and it is a question whether the range of any one species corresponds with the lines drawn on faunal zone maps.

A second method is the use of "major environments" and "minor environments," which was put forward with considerable diffidence in Shull, Larue and Ruthven, "Principles of Animal Biology," 1920.

These are essentially plant formations or forest areas. In some ways they are more serviceable than zones as plant formations can be *seen*. Also plants are somewhat more interdependent than animals and hence the ranges of more plants might reasonably be expected to coincide. Furthermore, plant formations play a large part in providing animal environment, as forest, prairie, etc., a part recognized in the term "major environment."

But, after all, the same objection holds in this case as in the case of the zones. Where there is a sharp change in plant formation there is usually a sharp change in topography or in soil conditions. Without such change there is no marked change in plant communities.

There is certainly an inherent absurdity in

defining the range of animals whose range one knows, in terms of the ranges of plants and animals whose range one does not know.

Lutz' method of "Geographic Average" (1921, *Amer. Mus. Novitates,* 5) involves considerable calculation, which brings to light with great effort the astounding information that the "mid-range" of a northern species is north of the "mid-range" of a southern species.

He voices considerable discontent with the zones as being indefinite and indistinct. Whereupon he proceeds to define anew the undefinable and to redistinguish the indistinguishable.

Inasmuch as all sharp changes in fauna are dependent on similarly marked changes in topography, it would seem reasonable to adopt physiographic regions, instead of zones, "major environments," and "geographic averages."

For the United States this has been made remarkably easy by the publication of "Physiographic Divisions of the United States," by Nevin S. Fenneman, *Ann. Ass. Amer. Geog.,* VI, 1917, which is the result of long continued work on the part of a committee of the association.

The lines of these divisions in many cases agree with the zones and with the plant formations. This is to be expected for the ranges of many animals should logically stop at a physiographic break, or at a line of sudden change in temperature or moisture, and the former usually carries with it the two latter.

Furthermore the use of these physiographic regions clears the way for intelligent association of animal and plant ranges with the geology and soil conditions, and brings to light routes of dispersal.

For instance, this system makes clear the presence of the Connecticut valley and the Hudson-Champlain trough, in which many southern forms extend north, but to draw these on the map as Upper Austral, indicating faunal identity with Piedmont Virginia (also Upper Austral) is sheer falsehood.

The beauty of this method, however, is its ease of application. These regions can be *seen,* their boundaries can be *seen,* and there is seldom any doubt as to which region one is in or from which specimens came.

Of course, all animals do not respect physiographic boundaries, any more than all animals respect the lines drawn on maps to represent faunal zones.

None of our methods of indicating general distribution is perfect. None ever can be. Zoogeographers might well give some consideration to the results of the "new geography," and afford themselves some justification for their title.

Emmett Reid Dunn

Smith College

CLINKERTILL, A NEW METAMORPHIC ROCK

In view of the interest attached to the study and identification of tillite a note about a rather unusual form of till may be of interest. This occurrence has never been described so far as the writer is aware.

Capping the northern bluffs bordering the Missouri river in portions of sections 16, 17 and 18, Township 154 west, Range 95 north, Williams County, North Dakota, is a typical bowlder-clay. This till lies on the truncated edges of the gently easterly dipping, lignite bearing, Fort Union Beds. In the sections mentioned above a heavy bed of lignite, here known as the Williston bed[1] immediately underlies the drift. Here as elsewhere the Williston bed has burned back from the outcrop baking the overlying till in places to a thickness of 30 feet or 40 feet. The clinkertill so formed varies in color from salmon-pink to dark brown, brick-red being the common color. In selected spots the material is fused to a porous, scoria-like mass but in most part is only slightly indurated by the heat. This baked till so formed resists weathering and removal and forms the capping of steep bluffs and buttes or mesas.

The most common pebbles found in this clinkertill are granite and limestone. The granite pebbles appear to be unaltered by the heat and the limestone pebbles but slightly as they effervesce freely in hydrochloric acid.

L. P. Dove

North Dakota Geological Survey

[1] Collier, A. J., "The Nesson Anticline," Bulletin 691 G., U. S. G. S., p. 213.

THE HOMING OF A DOG

IN this month's issue of *The Review of Reviews* is a copy of some notes taken by Professor Herrick of Cleveland, Ohio, and published in *The Scientific Monthly*. This refers to the "homing" of certain cats. I have had much experience in this line myself in my earlier years and can confirm what he says. My greatest story of this instinct, however, is not with cats but with a collie dog still living and in my possession. Canon City is distant from Denver something like 160 miles by rail. The D. & R. G. road passes southeast forty miles, then turns north to Denver. This course is necessary on account of the range of mountains divided by the Arkansas River. This range consists of many lofty peaks in which Pike's Peak is included, almost directly in line between Canon City and Denver.

One of our neighbors directly across the street moved by rail to Denver, taking this dog less than a year old with him on the train. In less than a week he was back at the old premises and barking joyously as ever. We adopted him and now for six years past he has been one of the family. He has given so many evidences of intellectual power that whole pages could be written of him. Possibly the remembrance of this episode in his life is the reason he will never voluntarily ride in any kind of vehicle. With his three feet yet remaining (one lost in coyote trap) he will travel miles to keep us company in an auto and when we take him in forcibly will leap out regardless of any speed we may be making.

W. D. HARRY

QUOTATIONS

CONTROLLING RESEARCH ENDOWMENTS

MEN of wealth do not always show wisdom in their endowments of science. Sometimes their ideas are fantastic. The late Mr. Carnegie, for example, early in the nineties, learned with surprise that there was still dubiety about the descent of man. He suggested buying Darwin's house at Down, putting up a sum of money and "settling the matter one way or another" in the decisive fashion of business. Later on his wealth and his knowledge, or his capacity for taking competent advice, grew, and he founded the splendid Carnegie Institution of Washington, a large part of the funds of which have since been continuously engaged on the more general problems of evolution, to the great benefit of knowledge, but without yet "settling Darwinism one way or another"!

Endowments on a princely scale are able to run on their own lines and to adapt themselves to the changing needs of science. But smaller funds are less flexible, and are often attached to a purpose so precise that their real utility may cease. Even if the original testators had ideas that were vague and liberal, the lawyers whom they employed to devise the terms of the trust, and the subsequent lawyers who have had to interpret them, have generally contrived to secure the maximum of rigidity. For such is the way of lawyers, preferring the form to the substance.

ROYAL SOCIETY TRUSTS

Our own Royal Society, to take an example of the disabilities arising from the rigidity of bequests, has over thirty separate trust funds to administer. The total income is not large, but it is relatively large as compared with the income that can be applied to the general purposes of the society. Every year the council begs possible donors not to tie up their gifts or their bequests. They state that in their experience "the usefulness of the Society for the Advancement of Natural Knowledge has been greatly hampered by the lack of funds which they could freely use according to their own judgment." All over the country, attached to scientific societies and institutions or to universities, there are many similar rigid endowments, given doubtless for a purpose that was urgent at the time, but now wasting zeal in their administration, and failing to make continuous additions to the progress of science from their inappropriateness to present needs.

There are many immediate objects which may appeal to the taste or to the imagination of the wealthy, and which could be gained within a reasonable time. It might be useful were the leading societies from time to time to draw up lists of these, with estimates of the possible period within which they might be completed and of the sums of money which

seemed necessary. A simple legal formula could be devised for the administration of such a specific bequest, with some provision against capitalization and the assignment of unexpended balances to some other object after a definite period. The donor's benevolence could be recorded in perpetuity, were the memoirs describing the results associated with his name.

THE AMERICAN PLAN

But there are also donors who wish to provide capital funds, large or small, for the perpetual benefit of science or of some branch of natural knowledge. One of the members of the National Research Council of America has proposed a scheme in which he hopes to have combined permanence with flexibility. In that western home of liberty a very large interference with what in Europe we still think the inalienable rights of the individual is not only advocated, but is accepted with docility, and I gather that the intention is to compel benefactors to wisdom.

It is proposed, in brief, that the board of trustees to whom is to be committed the administration of any permanent gift for the advancement of science should be elected at stated periods by a committee of electors. Of the latter, five are to be appointed annually, two chosen by the board itself, and three by some stable institution such as, for example, the National Research Council, which is a working organization of the National Academy of Sciences. The duration of office should be for five years, and a member would not be eligible for re-election for one year. The object is that every board of trustees should be chosen by persons a

majority of whom are approved representatives of the science or sciences named, fully conversant with the situation in the age in which they are acting, free from self-interest in the election, and, by virtue of their position, charged with responsibility for rendering this type of service.

The trustees so elected and so kept in continuous touch with the best interests of science should have full power in regard to the supervision of projects and expenditure of funds. But what is the vital element in the scheme is that they would have power to adapt the provisions of their original charter to what *they* conceive to be the object of the funds, so as to meet "changing conditions and needs in the spirit of the original intent of the donor." It is a very interesting proposal, which if carried out on a large scale would probably do much for the progress of science, and certainly increase to a very marked extent the power of the National Research Council. But *Quis custodiet ipsos custodes?* Is it quite certain that even a National Research Council will prove a perpetual fount of wisdom and impartiality?—London *Times*.

SCIENTIFIC BOOKS

An Advanced Course of Instruction in Chemical Principles. By ARTHUR A. NOYES and MILES S. SHERRILL. Complete Revision. pp. XVIII + 310. The Macmillan Company, New York.

PERHAPS in no other subject is the *method* which is employed for instruction more vital than it is in Physical Chemistry; for it is in that subject that the distinction between Power and Knowledge is probably most marked.

In striking contrast to the many books on this subject which are written from the purely descriptive point of view, books which are attractive because easy to read, but which leave the reader only with a vague knowledge of what has been done, and with no acquired power to apply the principles studied to the new questions of to-day and to-morrow, this book is intended primarily to make the principles and at the same time their general and specific application so clear, that the knowledge and the power to apply and use it practically are developed simultaneously. In other words, the problem-method of instruction, first introduced in Physical Chemistry by Speyers in his "Text-book," and amplified by the Reviewer in the second edition of his "Elements" (1902), is the method recognized in this work as the only one which will "give that intensive training which is essential for pursuing more specialized courses of scientific study, or for applying chemical principles to industrial problems."

It is to be regretted that the authors have not seen fit to include any journal-references in the text, either to the things directly con-

sidered, or to those which are expansions and continuations of them, for the student is thus confirmed in his bad habit of being satisfied with a statement from a text-book, rather than encouraged to seek the real source, the journal article. Another disadvantage arising from this lack of references is the very real danger that the reader will feel that at any point the last word had been said on the subject, whereas a glance at the original papers would show him in truth that it was only the first.

Since an international committee has already established a notation for use in Physical Chemistry, it would seem a pity that the authors in this text have adhered to a local one, for it will needlessly confuse the reader.

The fact that this is the final revision of the preliminary editions of 1917 and 1920 is assurance that few if any misprints or errors are likely to be found in the text.

A list of the chapter headings given below will show the general scope of the book:

Part I *The atomic, molecular and ionic theories and properties of substances directly relating to these theories.*
The composition of substances and atomic theory. The molal properties of gases and the molecular and kinetic theories. The molal properties of solutions and the molecular theory. The atomic properties of solid substances. The electrolytic behavior of solutions and the ionic theory.

Part II *The rate and equilibrium of chemical changes from mass-action and the phase view points. The rate of chemical changes.*
The equilibrium of chemical changes at constant temperature. Equilibrium of chemical systems in relation to the phases present.

Part III *The energy effects attending chemical changes, and the equilibrium of chemical changes in relation to these effects.*
The production of heat by chemical changes. The production of work by isothermal chemical changes in relation to their equilibrium conditions. The production of work from isothermal changes by electrochemical processes. The effect of temperature on work producible by isothermal chemical changes and on their equilibrium conditions. Systematization of free-energy values.

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SPECIAL ARTICLES

SAND DROWN, A CHLOROSIS OF TOBACCO AND OTHER PLANTS RESULTING FROM MAGNESIUM DEFICIENCY

IN connection with recent field investigations in the improvement of tobacco production conducted by the Bureau of Plant Industry in cooperation with the North Carolina Department of Agriculture attention was directed to a characteristic chlorosis of the leaves of tobacco plants on certain test plots. Investigation disclosed the fact that this disease often causes serious damage to the tobacco crop on certain types of soil, particularly in comparatively wet seasons. The popular name of this chlorosis is "Sand Drown," a term referring to the fact that the disease is likely to occur in aggravated form on the more sandy portions of the field after heavy rainfall. As a result of considerable field and laboratory study extending through several seasons this malady has been found to be due to an insufficient supply of magnesium in the soil or fertilizer. It has been found, further, that the ratio between the quantities of sulfur (sulfate) and magnesium contained in the fertilizer is a factor of importance, the symptoms of magnesium deficiency being intensified by increase in the quantity of sulfur applied to the soil. The details of the investigations will eventually appear in the *Journal of Agricultural Research* but because of considerable delay in publication resulting from temporary suspension of this journal it seems desirable to present at this time a brief outline of the principal facts established. The chlorosis in question usually begins at the tip and along the outer margins of the older leaves, advancing toward the leaf base and extending progressively to the upper leaves of the plant. In some cases, however, the chlorosis involves large portions of the leaf surface when first clearly recognizable. The veins and midrib of the leaf tend to retain their normal color. There is more or less complete blanching of the leaf lamina, both yellow and green chlorophyll pigments being affected

(thus differing from the chlorosis caused by potassium deficiency in which the affected area acquires a dull yellow color with a bronze or copper overcast). The blanched tissues usually do not die as quickly as in potassium deficiency so that local specking or spotting of the leaf is commonly wanting except in advanced stages of the malady. In some instances, however, local dying of the tissues between the veins has been the first symptom. In plot tests conducted in several tobacco-growing districts, in which chemically pure sources of nitrogen, phosphorus, potassium, calcium and sulfur were used instead of the ordinary commercial fertilizer materials, the symptoms of magnesium deficiency have usually appeared where sandy and sandy loam soils were used and there was abundant rainfall. In all such cases addition of sulfate or chloride of magnesium to the fertilizer salts has prevented the chlorosis. In comparative tests, applications of the so-called high grade or relatively pure commercial forms of the sulfate and chloride of potassium have resulted in severe chlorosis while low grade sulfates and chlorides of potassium containing considerable quantities of magnesium, such as "double manure salt" and "kainit," have prevented the disease. In some cases use of the purer forms of sulfate of potassium has resulted in severer chlorosis than that caused by the chloride and, moreover, the severity of the chlorosis has been proportional to the quantity of sulfate of potassium used. Symptoms of the disease also have been prevented by applying dolomitic limestone to the soil while comparatively pure calcite has been ineffective. Certain organic fertilizer materials of vegetable origin which are commonly used as sources of nitrogen, notably cotton seed meal, tobacco stalks and stems and barn manure, tend to prevent the disease. These materials contain appreciable quantities of magnesium. Use of other common sources of fertilizer nitrogen which contain little or no magnesium, including nitrate of soda, dried blood and especially ammonium sulfate, has favored development of the disease. In pot cultures this chlorosis is readily induced by applying a nutrient solution containing all the usual plant food elements except magnesium, using an excess of the solution so as to produce a leaching action on the soil. Moreover, the disease if not too far advanced is readily cured by adding magnesium to the nutrient solution. In view of the relation of the sulfur supply to the symptoms of magnesium deficiency it is worthy of note that an inadequate supply of sulfur *per se* results in a mild, diffuse type of chlorosis of tobacco, affecting all green parts of the plant and thus differing from the symptoms of magnesium deficiency. Since more or less sulfur is constantly added to the soil through rainfall, while there is loss of magnesium through the leaching action of the rain water, it is to be expected that symptoms of magnesium deficiency will be especially pronounced in wet seasons. In dry seasons the likelihood of relative deficiency of sulfur is increased. Experiments with corn, a crop plant differing widely from tobacco in many respects, show that it also is subject to the "sand drown" disease, the symptoms and characteristics of the disease in corn corresponding rather closely with those found in tobacco. It seems likely, therefore, that other crop plants are subject to injury from an inadequate supply of magnesium in the lighter, more sandy type of soils. Apparently the quantity of magnesium required in the fertilizer to prevent the symptoms of magnesium deficiency is small, probably less than 50 pounds per acre. These investigations suggest that the element magnesium needs to be taken into account both in the general problem of liming and in the proper choice of commercial fertilizer materials for making up so-called complete fertilizers.

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TRANSFERENCE OF THE BEAN MOSAIC VIRUS BY MACROSIPHUM SOLANIFOLII

IT has been assumed by pathologists that the virus of bean mosaic is transferred from diseased to healthy plants by insects. No experimental proof has been submitted to substantiate this claim. The only satisfactory ex-

planation of the widespread occurrence of the disease in certain seasons seems to be that occasional plants which show mosaic early in the season serve as the sources of infectious material which is carried throughout the field by virus-carrying insects. The probability of this being the correct explanation is strengthened by the known facts concerning the spread by insects of mosaic diseases of other plants.

Indirect proof of the relation of insects to the dissemination of bean mosaic was obtained during the summer of 1921. Plantings in late May of seed collected from plants showing mosaic the previous season were made in rows four feet apart. Another plot was planted at the same time seventy-five feet away with seed from plants grown for two previous seasons under insect-proof cages. These plants had shown no symptoms of mosaic. By the middle of July, practically all of the plants in the mosaic seed plot were showing symptoms of the disease. None of the plants in the clean seed plot had developed any signs of mosaic up to the time of the appearance of the second pair of leaves. Weekly inspection was made and the first case of mosaic was found in one plant of the Long White variety on June 12. A count was made each week of the new plants which had developed mosaic and on September 17, when the results were summarized, 19.5 per cent. of the total number of plants in the plot, which included twenty varieties, were affected with the disease. On July 15, clean seed from the same source as the above was planted in hills between the rows of diseased plants in the mosaic plot, half of the seed under insect-proof cages. By September 1, every plant outside of the cages was affected with mosaic, while not a single diseased plant appeared in the cages up to the time the plants were killed by frost. The diseased and healthy plants at all times during their growth were sufficiently far apart so that they did not come in contact with one another. This experiment indicated that insects are directly responsible for the dissemination of the disease.

In May, 1922, a planting of beans in the greenhouse was found to be infested with aphids. Several of the plants had early shown symptoms of mosaic. Growing some distance from the aphid-infested plants were a group of bean plants in water cultures. Practically every plant in these cultures developed a severe case of mosaic, and examination showed that the aphids were also abundant on them. Golden Wax and Green Pod Stringless beans were planted in pots in the greenhouse and the pots placed in cages. Brittle Wax beans were planted in the field and three cages placed over a portion of the row. In addition, a twenty-foot row of the same variety was planted and left uncaged for observation as to freedom of the seed from mosaic. As soon as the greenhouse and field plants had developed the first pair of leaves, aphids from the mosaic plants were transferred by means of a camel hair brush to watch glasses, and then placed on the leaves of three plants in one of the field cages, and on five plants of Golden Wax and three of Green Pod Stringless in cages in the greenhouse. Two cages of plants in the field as well as the additional twenty foot row were held for field checks. A large number of plants in pots were held in separate cages in the greenhouse as checks. The plants were inspected daily. After five days, three plants of Golden Wax and one of Green Pod Stringless showed apparent symptoms of mosaic as water-soaked areas along the veins which gradually involved the entire leaf. In addition there was a distinct down-curling of the leaves, usually characteristic of mosaic. This was contrary to usual observations which have been that when mosaic is transferred to healthy plants by aphids, symptoms of the disease do not appear on the inoculated plant until the new leaves have developed. However, with both of the varieties used the mottling was very distinct on the original leaves. Contrary observations on other plants have probably been due to the fact that it is difficult to detect mosaic symptoms on old leaves. After twelve days new leaves had appeared and these showed marked mosaic symptoms. These plants were held for eighteen days and the succeeding leaves continued to present characteristic mosaic markings. None of the plants in the check cages had developed any signs of mosaic one month after the beginning of the experiment, when they were discarded.

After seven days one plant of Brittle Wax in the field cage reacted similarly to the plants in the greenhouse. When the second pair of leaves appeared, mosaic markings were not apparent and it was thought that weather conditions had checked the progress of the disease in the plant. However, upon examining the plants one week later, two plants of the three upon which the insects had been placed had developed typical mosaic symptoms. All of the plants in the check cages, as well as in the twenty-foot row outside of the cages, have remained healthy up to this time, one month from the time of the appearance of the first pair of leaves.

The species of aphid used in these experiments has been identified by Miss Eugenia McDaniel of the entomology department as *Macrosiphum solanifolii*. This species has been collected on beans at other times, especially early in the season. *Phaseolus vulgaris* is one of the known hosts of this very polyphagous species.

SUMMARY

The spread of bean mosaic was observed during 1921 under conditions which strongly suggested transfer by insects. The sudden appearance of the disease in the water cultures of beans growing in the greenhouse, and infested with aphids, indicated even more definitely the mode of dissemination. Definite proof of the transfer of the virus by *Macrosiphum solanifolii* was obtained under controlled conditions, both in the greenhouse and in the field.

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THE EXTENSION OF THE X-RAY INTO THE ULTRAVIOLET SPECTRUM

IT was found that when thermions liberated from a tungsten filament were accelerated and allowed to impinge on a metal grid maintained at a variable positive potential, secondary electrons were emitted from the grid. The number of such secondary electrons emitted were measured by means of a galvanometer in series with the grid and a plate maintained at a constant positive saturation potential.

On plotting the secondary current as a function of the accelerating voltage, acting on the primary electrons, a sudden change in the slope of the curve occurring at critical potentials was interpreted in the usual way. The energy-quantum relation V(volts) L (Å) = 12320 was used to compute the equivalent wavelengths.

The following table gives the preliminary results thus far discovered. The quantities bracketed are still doubtful. Those preceded by an (*a*) are not found by the usual breaks in the curves but are positions on the continuous curves where the ratio of the number of secondary (s) electrons per primary (p) were such as indicated in the s/p column. At present it appears as if the convergence wavelength (s/p = 3) for tungsten ended at 91.2 Å and is followed by an absorption band extending probably down to 14 Å. This is then followed by the $M\alpha$ line, here extrapolated as 7.04 Å from the above measurements.

TUNGSTEN

Volts	Wavelength (Å)	S/P	Remarks
4.4	2800		Hull found 2700 shortest spark spectrum.
(17)	(725)		Suspected
35.0	352		
(60)	(205)		
135	91.2	3	Doubtful
144	*a*85.6	2.5	
181	*a*68.0	2.0	
295	*a*41.7	1.5	
435	*a*28.3	1.0	
( )	( )	0.0	
1750	7.04		Extrapolated X-ray data gives $M\alpha = 7.007$)

IRON

Volts	Wavelength	Remarks
3.3	3763	
8.5	1450	Millikan's iron spectrum shows 1430 and 1409.
10.4	1184.6	Also 1184.
24.3	507.0	Also 506 and 552.1. Intensity 7. $M\alpha$ computed from Sanford's formula gave 484 Å.
45.8	269	Iron shows spectrum 271.6 Å.
( )	*a*( )	Doubtful.
200	*a*61.6	

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